CLAIMS

1. A method of fabricating a line comprising:

providing a substrate having a hard mask material with a first thickness on the substrate;

forming a blocking layer on the hard mask material;

patterning the blocking layer and the hard mask material to provide a line segment, the line segment having a first dimension measured across the line segment;

reacting a surface layer of the line segment to form a layer of a reaction product on a remaining portion of the line segment not covered by the blocking layer; and

removing the reaction product without attacking the remaining portion of the line segment and without attacking the blocking layer and the substrate to form the line segment with a second dimension across the line segment that is smaller than the first dimension, and wherein the thickness of the hard mask material remains equal to the first thickness.

2. The method of claim 1, wherein the step of reacting a surface layer of the line segment comprises a self-limiting reaction.

3. The method of claim 1, wherein the first dimension is a minimum dimension achievable with a photolithographic process.

4. The method of claim 1, wherein after the step of removing the reaction product, the second dimension of the line segment is a sub-lithographic dimension.

5. The method of claim 1, wherein after the step of removing the reaction product the line segment is used to form a gate electrode of an FET.

6. The method of claim 1, wherein the hard mask comprises silicon dioxide or silicon oxynitride.

7. The method of claim 1, wherein the step of reacting a surface layer of the line segment comprises HF and NH_3.

8. The method of claim 7, wherein the step of removing the reaction product comprises heating or dissolving the reaction product in a solvent comprising water.

9. The method of claim 1, wherein the blocking layer comprises silicon.

10. The method of claim 1, wherein the blocking layer comprises germanium.

11. The method of claim 10, wherein after the step of removing the reaction product the blocking layer is removed without attacking the line segment and the substrate.

12. The method of claim 11, wherein the blocking layer is removed by a solution comprising hydrogen peroxide.

13. The method of claim 1, wherein the blocking layer is formed by sputter deposition.

14. The method of claim 1, wherein the blocking layer has a thickness from about 35 Angstroms to about 50 Angstroms.

15. The method of claim 1, wherein the step of patterning comprises providing a plurality of lines of approximate line widths.

16. The method of claim 1, wherein after the step of removing the reaction product, the second dimension is about 10 nanometers to about 40 nanometers smaller than the first dimension.

17. The method of claim 16, wherein the second dimension is about 20 nanometers to about 30 nanometers smaller than the first dimension.

18. The method of claim 1, wherein the step of removing the reaction product comprises heating to a temperature of about 100°C or above.

19. The method of claim 1, wherein the step of reacting a surface layer of the line segment comprises HF and NH_3 at a ratio of about 2:1.

20. The method of claim 19, wherein the reacting is carried out under pressure of about 0.5 mTorr to about 50 mTorr and a temperature of about 10°C to about 35°C.

21. A line obtained by the method of claim 1.

22. The method of claim 1, wherein the step of reacting a surface layer of the line segment comprises a vapor phase etch.

23. The method of claim 1, wherein the step of removing the reaction product comprises heating to a temperature of about 100°C to about 200°C.

24. The method of claim 1 further comprising providing a photoresist on the blocking layer and removing it prior to the step of reacting a surface layer of the line segment.

25. The method of claim 24, wherein the blocking layer functions as an ARC layer.

26. A method of fabricating a plurality of lines comprising:

providing a substrate having a hard mask material with a first thickness on the substrate;

forming a blocking layer on the hard mask material;

patterning the blocking layer and the hard mask material to provide a first line segment and a second line segment, the first line segment having a first dimension measured across the first line segment, and the second line segment having a second dimension measured across the second line segment;

patterning a blocking mask on the first line segment;

reacting a surface layer of the second line segment to form a layer of a reaction product on a remaining portion of the second line segment not covered by the blocking layer; and

removing the reaction product without attacking the remaining portion of the second line segment and without attacking the blocking layer and the substrate to form the second line segment with a third dimension across the second line segment that is smaller than the first dimension of the first line segment, and further wherein the thickness of the hard mask material remains equal to the first thickness.

27. The method of claim 26, wherein the blocking layer comprises silicon.

28. The method of claim 26, wherein the blocking layer comprises germanium.

29. The method of claim 28, wherein after the step of removing the reaction product, the blocking layer is removed without attacking the line segment and the substrate.

30. The method of claim 29, wherein the blocking layer is removed by a solution comprising hydrogen peroxide.

31. The method of claim 26, wherein the step of reacting a surface layer of the second line segment comprises a self-limiting reaction.

32. The method of claim 26, wherein in the step of patterning the blocking layer and the hard mask, the first dimension and the second dimension are equal.

33. The method of claim 26, wherein the blocking mask comprises photoresist.

34. The method of claim 26 further comprising providing a photoresist on the blocking layer and removing it prior to the step of patterning a blocking mask on the first line segment.

35. A method of fabricating a line comprising:

providing a substrate having a hard mask material with a first thickness on the substrate;

forming a blocking layer with a second thickness on the hard mask material, wherein the blocking layer comprises an anti-reflective coating;

patterning the blocking layer and the hard mask material to provide a line segment, the line segment having a first dimension measured across the line segment;

reacting a surface layer of the line segment to form a layer of a reaction product on a remaining portion of the line segment not covered by the blocking layer; and

removing the reaction product without attacking the remaining portion of the line segment and without attacking the blocking layer and the substrate to form the line segment with a second dimension across the line segment that is smaller than the first dimension, and wherein the thickness of the hard mask material remains equal to the first thickness.

36. The method of claim 35, wherein the first and second thicknesses are selected such that a first light wave reflected from a surface of the blocking layer has an intensity equal to a second light wave which is transmitted through the blocking layer and the hard mask material, reflected from a surface of the substrate, and again transmitted through the hard mask material and the blocking layer, and further wherein the first light wave is 180 degrees out of phase with the second light wave.

37. The method of claim 36, wherein the hard mask comprises oxide with a first thickness from about 400 to about 600 Angstroms and the blocking layer comprises silicon with a second thickness from about 40 to about 45 Angstroms.

37. The method of claim 35, wherein the anti-reflective coating comprises silicon.